

What is claimed is:

1. A Commutator for an electric motor that includes a plurality of power supply brushes, which are slidably engaged
5 with the commutator, the commutator comprising:

a plurality of conductive commutator segments, which are arranged at generally equal angular intervals in a circumferential direction of the commutator, wherein the commutator segments are divided into a plurality of groups, each
10 of which includes two or more of the commutator segments;

a plurality of generally planar short-circuiting parts, which are respectively provided to the groups of the commutator segments and are located radially inward of the commutator segments in such a manner that the short-circuiting parts are spaced one after the other in an axial direction of the commutator,
15 wherein each short-circuiting part is seamlessly and integrally formed with and is electrically connected to at least a portion of each commutator segment of a corresponding one of the groups of the commutator segments, and at least one of the
20 short-circuiting parts is located within an axial extent of at least one of the power supply brushes measured in the axial direction of the commutator; and

a dielectric body, which securely holds each commutator segment and each short-circuiting part.

2. The commutator according to claim 1, wherein the commutator segments of each group are arranged at generally equal angular

intervals in the circumferential direction of the commutator.

3. The commutator according to claim 1, wherein the short-circuiting parts are displaced from one another by a predetermined angle in the circumferential direction of the commutator.

4. The commutator according to claim 3, wherein the predetermined angle is defined by the following equation:

the predetermined angle = $360 \text{ degrees} \times 1/\text{the number of commutator segments}$.

5. The commutator according to claim 1, wherein:

each commutator segment includes a plurality of sub-elements, which are stacked in the axial direction of the commutator; and

each sub-element is located in a corresponding imaginary plane, which is perpendicular to the axial direction of the commutator, and in which a corresponding one of the short-circuiting parts extends.

6. The commutator according to claim 5, further includes a plurality of conductive spacer elements, wherein each of the spacer elements is interposed between corresponding two of the sub-elements in the axial direction of the commutator.

7. The commutator according to claim 5, wherein:

an engaging surface of one of each adjacent two of the sub-elements of each commutator segment has one of an axial recess and an axial projection, wherein the axial projection is press fitted into the axial recess; and

5 an engaging surface of the other one of the adjacent two of the sub-elements, which is engaged with the engaging surface of the one of the adjacent two of the sub-elements, has the other one of the axial recess and the axial projection.

10 8. The commutator according to claim 1, wherein:

each short-circuiting part has an annular small diameter portion and a plurality of connecting portions, wherein the connecting portions extend radially outward from the annular small diameter portion; and

15 each connecting portion of the short-circuiting part is connected to a corresponding one of the commutator segments of the corresponding one of the groups of the commutator segments.

20 9. The commutator according to claim 1, further comprising a plurality of connectors, to which armature winding coils of the motor are connected.

10. An electric motor comprising: ✓

a stator that includes a plurality of field poles; and

25 a rotor that is rotatable relative to the field poles and includes a commutator; and

a plurality of power supply brushes, which are slidably

engaged with the commutator, wherein the commutator includes:

a plurality of conductive commutator segments, which are arranged at generally equal angular intervals in a circumferential direction of the commutator, wherein the commutator segments are divided into a plurality of groups, each of which includes two or more of the commutator segments;

a plurality of generally planar short-circuiting parts, which are respectively provided to the groups of the commutator segments and are located radially inward of the commutator segments in such a manner that the short-circuiting parts are spaced one after the other in an axial direction of the commutator, wherein each short-circuiting part is seamlessly and integrally formed with and is electrically connected to at least a portion of each commutator segment of a corresponding one of the groups of the commutator segments, and at least one of the short-circuiting parts is located within an axial extent of at least one of the power supply brushes measured in the axial direction of the commutator; and

a dielectric body, which securely holds each commutator segment and each short-circuiting part.

11. A method for manufacturing a commutator that includes a plurality of commutator segments arranged at generally equal angular intervals, the method comprising:

stacking a plurality of conductive blank plate members in such a manner that the blank plate members are circumferentially displaced from one another by a predetermined angle, wherein each

blank plate member includes an annular part and a short circuiting part, and the short circuiting part is located radially inward of the annular part and is connected to a plurality of points of the annular part, which are arranged at generally equal angular intervals in the circumferential direction of the annular part;

filling a dielectric material in a liquid phase in a space defined radially inward of the annular parts of the blank plate members;

solidifying the dielectric material;

radially cutting the annular part of each blank plate member at a plurality of predetermined cut points, which are circumferentially arranged at generally equal angular intervals, to divide the annular part of the blank plate member into a plurality of portions, each of which serves as a sub-element of a corresponding one of the commutator segments.

12. The method according to claim 11, wherein the solidification of the dielectric material results in that each divided portion of the annular part of each blank plate member and each short-circuiting part are securely held by the solidified dielectric material.

13. The method according to claim 11, wherein the predetermined angle is defined by the following equation:

the predetermined angle = 360 degrees x 1/the number of commutator segments.

14. The method according to claim 11, wherein the stacking of the blank plate members includes press fitting of axial projections of one of each adjacent two of the blank plate members into axial recesses of the other one of the adjacent two of the blank plate members.

15. The method according to claim 11, wherein:

the stacking of the blank plate members further includes stacking of a plurality of annular conductive spacer plate members relative to the blank plate members in such a manner that each spacer plate member is interposed between the annular parts of corresponding two of the blank plate members; and

the radially cutting of the annular part of each blank plate member further includes radially cutting of each spacer plate member at the predetermined cut points.

16. The method according to claim 11, wherein:

the stacking of the blank plate members further includes stacking of an annular conductive connecting plate member to the annular part of one of the blank plate members, wherein the connecting plate member includes a plurality of connectors to be connected to armature winding coils; and

the radially cutting of the annular part of each blank plate member further includes radially cutting of the connecting plate member at the predetermined cut points.